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rate instruments. Other stations are then chosen, until all the angles of the different triangles throughout the country are correctly ascertained. We have now the data for laying down all the points so observed; but as yet, we have no notion of the real distances of any of the objects, or, in other words, of the size of the country, because the angles give only the ratio which the sides of the triangles bear to each other.

It is easy to imagine that, as all the triangles are in contact, if we either know, or assume the length of a side of any one of them, we can immediately deduce the relative dimensions of all the others. It is therefore necessary to measure some one side by actual application of some standard measure—as feet, yards, or miles, by which we shall establish the distances and dimensions of the whole survey. The line so measured is technically termed a 'base line,' because it serves to regulate and give a positive value to all the calculations. When the principal points are thus fixed, the succeeding process of filling in the intervals between them, is a comparatively easy operation; and the ultimate survey of the detail presents still less difficulty. Now, were the earth a perfectly level plane, or nearly so, and were the air always clear, the general triangulation would require little more care than is necessary for land-surveying in general. Points might be chosen at convenient distances, and no considerable source of error would lie in the way of a perfect representation, save the inevitable inaccuracy of the instruments employed to measure the angles. Such, however, is not the case in reality. Mountains, lakes, and rivers, interfere to prevent the view, or remove the stations to such distances from each other, as to be visible with difficulty, after great fatigue of constant watching; and the different level of the stations so found, requires the most careful calculation.

We shall have occasion presently to notice the extreme difficulty attending this part of the survey; but, in order to give our readers a general view of the whole operation, we request they will presume the triangulation to be already effected, by the means we have described.

We proceed to the measurement of a base line. Now, it is obvious enough, that the longer this line is, the greater will be the accuracy of the whole survey; but here still greater difficulties appear than in the business of triangulation. It is easy to see a distance of forty or fifty miles from the tops of mountains across valleys; but it is very difficult to find a piece of ground of any considerable extent, so level as to enable us to measure a continued line with the accuracy requisite in establishing a base line; for the measure we use cannot, to be manageable, exceed a few feet in length. Thus it happens, that the base line always bears a very inconsiderable proportion to the whole survey, or even to the sides of the great triangles; and the shorter this line, the greater must be the minute accuracy with which it is measured; because an error, though trifling in itself, is multiplied into a sensible quantity before the work is nearly gone through.

We may here remind our readers, that inaccuracies of measurement are never very important but when they are liable to increase by frequent repetition. Thus, if we compare two yard measures, it is easy to see whether they are

the same length within the 100th of an inch—a degree of accuracy more than sufficient for ordinary purposes; but if we wanted to ascertain the length of a yard, and had only one inch of it to measure, the case would be very different; for then, if we made an error of 1-100th of an inch, it would give the yard an error of 36-100ths, or more than one-third of an inch.

In measuring a line of some miles, with rods of a few feet only in length, it may be imagined that the error induced by constant repetition, would be increased far beyond that of the familiar example we have just given, supposing the causes of error to remain the same. Now, these causes are principally the expansion and contraction of the rods employed, in different states of the atmosphere. All substances expand by heat, and contract by cold, but in very various degrees; for instance, among the metals, brass is more expansible than steel, and lead more so than either. Wood alters its length by change of temperature less than any metal, but still it is affected to a considerable degree; besides which, its expansion is influenced by moisture—a circumstance that renders it unfit for any very nice measure. There being no substance in nature which is adapted singly to form an invariable standard of length, recourse was had to the method of compensation, on the principle of that already practised with the pendulum,—namely, by making two rods, one of brass, the other of steel. They were ten feet long, and placed parallel, about two inches from each other. The ends were connected by cross pieces, fixed to each bar by a pivot, and projecting two inches beyond the bars. At the ends of these cross-pieces was a small plate of silver, having a minute dot so situated that the superior expansion of the brass rod, beyond that of the steel one, caused this dot to retain its place, whatever change of temperature the apparatus might be exposed to. The rods were enclosed in wooden boxes, standing on trestles, and provided with the most careful adjustments in every direction. The ends of the rods did not touch as they were put successively in advance; but a box provided with two microscopes was fixed between the ends of the bars,—the distance between the centres of these microscopes was six inches,—and they were also mounted on the principle of compensation. The dots on the cross-pieces of the rods were brought precisely into the foci of the microscopes, so that the space advanced by every shifting of the rods was 10 feet 6 inches. This apparatus was executed by those eminent mechanicians, Messrs. Troughton and Sims, and comprised a great variety of ingenious contrivances of difficult execution, which it is impossible to render intelligible by mere description. The principle alone, we trust we have explained, and it therefore remains for us to advert to the actual operations performed by this curious mechanism.

The position which seemed to offer the least difficulty was a flat piece of ground, on the east shore of Lough Foyle, in Londonderry. The ground, for the distance of seven miles and three quarters, was there sufficiently level for the purpose, but the river Roe was to be crossed; and if this had been of extraordinary depth, it would have been a fatal obstacle—unless, indeed, it had been thought worth while to build a bridge;—as it was, however, the surveyors, by driving piles, were enabled to construct a firm platform for the apparatus, quite across the stream, which was 460 feet broad. To prove the extreme accuracy of these operations, it

may be mentioned that the breadth of the river was measured twice, and the two measurements differed from each other only 1-38th of an inch. A mountain prevented the further extension of the base line; but as it was thought advisable that it should be ten miles long, it was continued to that extent by careful triangulation; and it was presumed that the greatest error did not amount to more than half an inch in the whole line.

Having thus traced the leading features of the survey, we may be permitted to mention some interesting facts attending the operations.

With respect to the great triangulation, the stations were often recognized at distances which seem scarcely credible, considering the generally hazy atmosphere which prevails in northern latitudes near the sea. The extraordinary light produced by exposing quick-lime to the action of oxygen and hydrogen gases, was found to be visible at an immense distance in the night-time, while the ingenious contrivance, called the Heliostat, which reflects the sun's rays from a mirror constantly to one point, was resorted to by day. These aids were so efficacious, with the assistance, moreover, of powerful telescopes, that we find, among the many observations during the triangulation, that objects were recognized at the following extraordinary distances:—101, 98, 93, 101, 85, and 107½ miles; and, in one instance, when making an observation across the Channel, from a mountain in Pembrokeshire, to one in the county of Wicklow, in order to connect the survey of Ireland with that already performed in Wales, the distance seen was 108 miles; but, to give an idea of the difficulty attending such operations, it is sufficient to state that the observer, in this case, waited five weeks before he could accomplish his purpose.

During the whole of this survey, above 600 persons, of different conditions, were, and are still constantly employed, either in measuring, calculating, drawing, engraving, or performing the laborious part of the undertaking; the consequent expense, as may be imagined, is very great; but we are happy to bear ample testimony, which we do from our own long and careful observation, to the zeal, ability, and diligence of the officers under whose superintendence the work is conducted.

For the greater part of the foregoing information, we are happy to acknowledge our obligations to Mr. Faraday. The topographical details yet remain untouched; but as our private resources fortunately enable us to throw considerable light on this most interesting and important subject, we shall feel happy to resume it ere long.

#### HIGH-WAYS AND BYE-WAYS IN IRELAND.

BY AN ANTIQUARY.

##### No. III.

*Antiquary.*—Why is it, Mr. President! that in the candour of my nature I must alternately reflect your praises and your censures?

*President.*—The caprice of a minstrel boy!  
"amant alterna camœnas."

*Antiquary.*—No sooner had I begun to pat and caress you, than I am cruelly convinced "my hand was on the Lion's mane."

*President.*—Ha! apropos, the Zoologicals may—

*Antiquary.*—Nay, Sir! I must be heard. I have dedicated certain HIGHWAYS AND BYEWAYS

to the public, I have run them through churchyards, turnpikes, and noblemen's demesnes; I have done so at my sole charges and expenses, not like

Agmondisham Vesey, who, out of his bounty, erected a bridge—at the cost of the county.

Yet you, Sir! contrary to good order, neighbourly feeling, and the provisions of the road act, have shamefully and unjustly, and to the common prejudice and disappointment of “the finest people in the world,” cut, maimed, *fore-shortened* and *cartailed* the said Highways and ———

*President.*—Marry I approved well of your productions and did but lop them, that, like the worm, they might multiply by dissection.

*Antiquary.*—Sir there was comparative humanity in Procrustes, but you have treated me to the literary fate of Metius; you have torn my every limb asunder, and this with such a wrench that none can longer distinguish the “dissecta membra poetæ.”—The Caulfields are cartailed of their fair proportion, Cheated of future ———

*President.*—By the printer's devils!

*Antiquary.*—Lord Toby is left a whole week at the mercy of the rabble. My great rebellion, like the cobbler in the song, “made an end when beginning,” and above all “The Casket,” the very palladium of my plot, is left poised between the past and a future that depends on your caprice. My very character is mutilated, and my fair fame ———

*President.*—Aut insanit aut versus facit—a crack in the skylight unquestionably (sotto voce) — Come, come, Sir, enough of this foolery. You forget it is by our sufferance you are permitted to wander among the columns of our literary fabric, and we were unworthy of the empire of letters (we don't acknowledge a republic,) if we suffered our autocracy to be questioned.

*Antiquary.*—At least, Sir, let me entreat that none presume to read this, my number, who has not well digested its precursors:

THE CAULFIELD'S continued.

Lord Charlemont and his family remained prisoners in their own fort for fifteen weeks, at the expiration of which, the former was removed to Kinard, Sir Phelim's own castle; but at the moment of his entrance, he was mortally wounded by a shot from the fosterer of O'Neill.

In the meantime, the rebellion strengthened, the more especially when Sir Phelim proclaimed to his deluded countrymen, that he had the king's authority for all he would inspire them to effect; in corroboration of which he boldly produced a parchment with the great seal appending, which he affirmed to be the royal commission. The confidence of this assertion dismayed the Protestants of the puritanic party, who entertained no favourable sentiments for Charles, and who, at sight of the great seal declared, at once that they were a sold people.

At this day, the very terms in which this instrument was couched, would be sufficient to discredit it; and on the termination of the unhappy troubles, those who were most active in fomenting them uniformly declared, that they had no commission from the king to warrant their actions.

Sir Phelim in the end sought concealment in an obscure island off the Northern shore of Ireland, where, by a strange retribution of Providence, he was discovered by the fifth

Lord Charlemont. He was instantly brought to trial; and it is but just to record of him, that in that perilous hour, and even at the place of his execution, when he was repeatedly tempted by offers of his estate and liberty, if he would but confess he had acted by the authority of Charles, and produce any probable proof of the charge, he peremptorily declared that he never had received any commission; adding, that his conscience was already oppressed by the outrages of his followers, and that he could not aggravate the poignancy of his present feelings by an unjust calumny of the king.—It was then, however, that the secret of the casket first transpired: it had contained the confirmation patent of the second Lord Charlemont's estate, with the king's broad seal appended, which Sir Phelim confessed he took from the authentic document, and affixed to a sham commission suited to his purposes.

Mr. Carte speaking of this transaction says, that about two years before the publication of his *Life of Ormond*, the very patent from which the great seal was so torn, was produced in evidence at the assizes of Tyrone, by the then late Lord Charlemont, exhibiting in its appearance evident marks of the seal being torn off, with an endorsement proving the fact, and it was allowed by the judges to be authentic. Another tradition connected with this event is, that the Earl of Orrery, who had a strange pleasure in misleading posterity, *built a ruin* at Caledon, which he ornamented with the hewn stone of Sir Phelim O'Neill's castle, (distant about a mile thence,) and actually inscribed a worthless poem of his own, on one of the stones, to signify to the traveller that this was the seat of the great O'Neill.

In the narrative we have given, we have trod more lightly than others on the grave of the O'Neill; as we cannot but in justice remember that he lived in times, which only the most virulent partizans have recorded. The lights of history must be regarded with a steady eye, when, like the midnight beacons on a barbarous coast, they are kindled but to mislead inquiry.

The fifth Lord Charlemont (before mentioned) was known by the euphonious epithet of “the good.” By his will he ordered that he should be buried in the church of Armagh, and earnestly entreats his overseers that they would take up the bones of his old deceased father, put them in a new coffin, and lay them beside him, a request which was duly complied with.

In 1666, Thomas Caulfield was vice-president of Connaught. In 1686, Captain Toby Caulfield signalized himself at Tangiers, and is the subject of much eulogy in the letters from Lord Clarendon to the Earl of Sunderland. In 1689, William Lord Charlemont was of those attainted by the parliament of King James the Second. In 1705, he signalized himself in Spain under Charles Earl of Peterborough, particularly at the siege of Barcelona.

Of the late Lord Charlemont, we shall only say, that the proudest pages of Irish history are his biography. Having visited every part of the continent that a classic recollection could endear, he returned to the service of his country, the accomplished scholar, the independent statesman, the devoted patriot. He it was that at the head of the celebrated society of the Dilettanti, gave the tone to excursions and arrangements that led to Dr. Chandler's “*Travels through Asia Minor*,”

his “*Travels through Greece*,” “*The Ionian Antiquities*,” &c. At the first institution of the Royal Irish Academy, he was elected its president, and it was by his zeal that the whig club was subsequently instituted in our metropolis. There are some who would fain object one, and but one, aberration in his political career; but we rejoice to think these topics may now be numbered with the years beyond the flood; and Charlemont deserved too well of his country to be named by Irishmen with other feelings than those of pride, gratitude, and veneration.

Adieu, Sir, for the present. We meet again at Philippi, i. e. at the charter-school. Start not. I do not mean to tarry long there: especially if we find the schoolmaster abroad—for as our old school-fellow Horace said, when he saw a charter school with similar sympathies,

“*Absentem qui rodit amicum*  
Hic niger est, hunc tu Romæ caveto.”  
Verbum sat! — Clontarf and the Vernons in our next.

Summer-hill.

D.

## FINE ARTS.

### ROYAL IRISH INSTITUTION.

We take some blame to ourselves for not having sooner noticed the very interesting exhibition of the works of the old masters, which has been open for some time at the gallery of this Institution. A collection of pictures of this kind, even though they be not of first-rate excellence, affords a delightful intellectual enjoyment, and in a country circumstanced like ours, is of national importance, inasmuch as it offers one of the very few opportunities of which the public can avail themselves, of cultivating a taste for the fine arts. We, therefore, recommend it strongly to the attention of our readers, but, at the same time deem it our duty to warn the uninitiated in art against supposing that all the works thus held up for admiration are really deserving of praise. There are, in fact, but few *great works* of art in the collection, and many that have no claim whatever to excellence, beyond mere mechanical skill. This is not as it should be, in a collection assembled together for the avowed purpose of improving the public taste. The committee should evince a sounder judgment, and not bring forward works that only tend to mislead the minds of those who know no better. Even if paintings of high excellence could not be procured, (which, however, we have reason to know is not the case,) they could at least abstain from covering their walls with works of altogether an inferior class. Private feelings should have no influence whatever in an institution like this, and still less a childish regard for great names in art, quite independent of merit in the examples. How will the public taste be improved by the study of such works, for instance, as—No. 48, The Holy Family—Sasso Ferrato; 49, The Decollation of St. Catherine—Albert Durer; 50, The Saviour with Mary and Martha—Lang Jan and Snyder's; and many others that we could name? Or will they form any just estimate of the talents of the divine Raphael, or of the prince of landscape painters, Claude Lorraine, by such specimens as 34, The Holy Family, by the one, and 24, the Landscape, by the other? The former we may safely aver that Raphael never saw; and the latter is in such an *improved* state, that if Claude could now behold